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Practical Brass Pipe Plumbing

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How to Cut, Thread and Install Brass Pipe

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Following established custom, Brass Pipe sizes are referred to in this book as "I. P. S." or "Iron Pipe Sizes." The expression "Standard Pipe Sizes" has recently come into use. Where it occurs it may be taken to have the same meaning as "Iron Pipe Sizes." The two terms mean the same thing.

SUMMARY

Ten Rules for Installing Brass Pipe

1. Use only good brass fittings with threads of standard gauge and size. Do not use iron fittings on a brass pipe job.

2. Cut the pipe with your regular cutters or with a hack saw. Ream the pipe to remove all burrs.

3. Use good dies without broken teeth.

4. One quarter of an inch per ten feet of length is ample allowance for expansion for hot and cold water lines.

5. When threading keep the pipe as near to the vise as is consistent with easy working.

6. While a lubricant is not absolutely necessary, it facilitates threading.

7. Use care in threading and cut the threads down to exactly standard gauge and size.

8. With properly made dies run the die onto the pipe until its surface is just flush with the pipe. When such threaded pipe is screwed home in the fitting no threads will show.

9. Best appearance in the finished job is obtained by using friction jaws in the vise and friction wrenches. Use care if you screw brass pipe home with a Stillson wrench so as not to unduly mar it.

10. With careful threading, good fittings and proper screwing home, no pipe "dope" is necessary. Wicking is recommended as preferable to a paste of ground red lead and glycerine, or red lead and linseed oil.

Table of Contents

Ten Rules for installing brass pipe 3

Selecting the brass pipe 8

Selecting the fittings 10

Tools for installing brass pipe:

Vises 11

Cutters 12

Wrenches 13

Cutting the pipe 14

Threading the pipe 16

Reaming the pipe 21

Making up the joints 24

"Dope" for pipes 28

Bending the pipe 29

Installation 31

Hangers 31

Expansion 34

Pipe sizes and capacities 37
(tables)

Manufacturers 43

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How to Cut, Thread and Install Brass Pipe

Knowing How Makes Doing Easy

THE ever-increasing demand for brass pipe and brass fittings in modern plumbing construction calls for a general knowledge by plumbers of safe, sure, and quick methods of working the pipe.

Because of the knowledge and experience which many plumbers have already gained in the installation of brass pipe, it may seem superfluous to outline the best methods of working procedure. But a summary of proper methods will no doubt add to the skill of plumbers who are already experienced in the work and will assuredly be of great help to those who are less familiar with the best practice.

The fact, known to plumbers who have had experience with brass installations and readily manifest to others now acquiring that experience, is that good modern brass pipe can be handled as easily and almost as quickly as iron or steel pipe if the plumber goes about the work in the right way.

Simple Operations

The operations are very simple. They just require a few different tools which are inexpensive, and a little special information. The special tools can be bought from any reputable plumbers' supply house. As for the special information the purpose of this book is to furnish it so that every plumber may more readily acquire the knack of correctly cutting, threading and installing brass pipe.

The Kind of Brass Pipe to Install

Before talking about the tools and methods of handling them, consideration will be given to the best kind of pipe and fittings to install, for it is not wise to purchase wrong kinds of materials and then put expensive skilled labor on them. If the materials are poor, the finished work must necessarily be poor, and perhaps uncertain, no matter how skillfully they may be handled and installed.

This book will not go into the science of brass pipe making, nor into its composition or physical properties. These, after all, are the business of the pipe makers and may be left to them. The main things for the plumber to know are how to order the right kind of pipes and fittings, and how to determine that he is getting what he orders.

Ordering the Pipe

He should order semi-annealed seamless brass pipe I. P. S. (which means iron pipe size), of a reliable manufacture, or brand, which he should specify in his order. The concerns listed at the back of this book furnish excellent grades of brass pipe suitable for plumbing. It is not enough for the plumber just to order so many feet of brass pipe. It is necessary for him to state—"iron pipe size" semi-annealed, and those particular makes or brands which he knows to be reliable. If the pipe is to be bent he should specify "soft-annealed."

Specific mention of reliable manufacturers is made because in the past some imperfect brass pipe found its way on the market. These pipes pro-

duced years ago may in some instances have given trouble due to improper manufacture. Nowadays, brass pipe manufacture is much better understood than it was ten years ago and no trouble should be experienced with brass pipe produced by a good manufacturer.

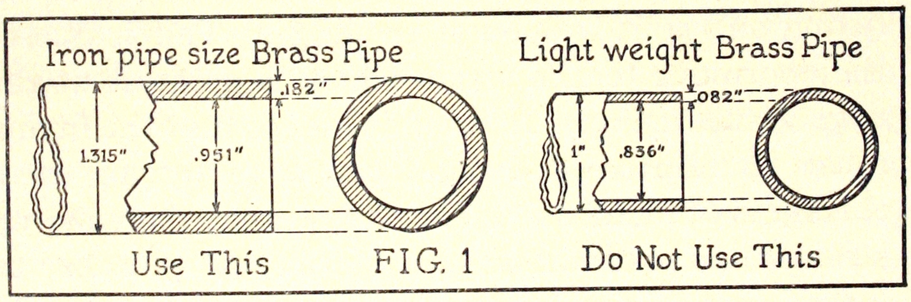
Ordering the Pipe

Responsible mills listed in this book turn out thoroughly reliable brass pipes, on which any first-class plumbing concern may safely stake its reputation. Knowing these facts, the plumbing trade should have no difficulty in purchasing brass pipe that is absolutely dependable.

The principal reason why "iron-pipe-size" brass pipes should be used, instead of thinner tubes, is to leave a sufficient thickness of metal at the root of the threads to insure a reasonable degree of strength where the pipes enter the fittings.

Pipe Threads

The threads used on I. P. S. brass pipes, and in their fittings are the regular "Briggs' " thread which is the iron pipe standard thread of the United States.



Kind of Pipe to Use

Fig. 1 illustrates the difference in thickness between I. P. S. brass pipe and thinner tubes that some plumbers in certain localities in the United States have installed, using fine threads. However, practical experience with thin brass tubes and fine thread fittings for plumbing purposes has taught the trade to favor "iron-pipe-size" brass pipes and their use has become a universal practice.

Brass Fittings for Brass Pipe

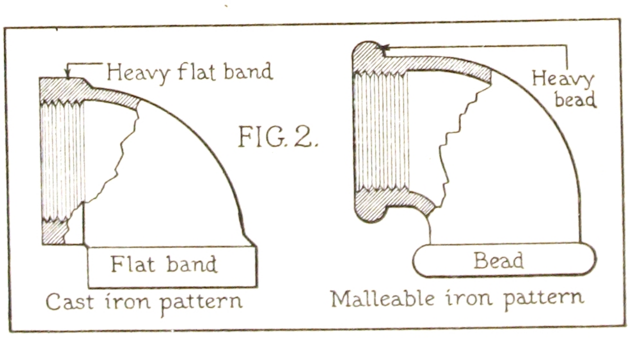
As for the fittings that go with brass pipe they should be brass also, heavy cast brass; not cast iron —not galvanized iron—not plain malleable iron—but all brass. There is a good reason why brass fittings only should be used with brass pipe. It is for the sole purpose of durability. When iron fittings are used with brass pipe a case of dissimilar metals is introduced which is conducive to electrolytic decomposition of the iron fittings.

To insure freedom from that destructive agency, brass should be used throughout the entire piping system. This assures the greatest degree of perfection obtainable.

Brass fittings should have approximately the same composition as the pipe. They must also be strong and free from sand holes or flaws, and must have clean-cut full threads of standard gauge and size.

Screwing-up Strains

Standard pipe threads are tapered. A tapered thread screwed into a fitting tends to swell out the fitting and split it open at the edge. This is due to the enormous tensile strain which is greatest at the edge of the fitting. In brief, it means that the fitting must be reinforced around the edge by an extra thickness of metal sufficient to resist the screwing-up strains, and so make it possible for the plumber to install screw joints that will be watertight, strong, and permanent.



Reinforced Fittings

Fig. 2 illustrates two common patterns of fittings. One has a reinforcement around the edge of each opening in the form of a flat band. The reinforcement at each opening of the other pattern is in the form of a bead. The former is frequently known as the "cast pattern" because it resembles the cast iron fittings used on steam pipe work. The other is sometimes called the malleable pattern as it resembles the galvanized malleable iron fittings so commonly used on water piping.

Types of Fittings

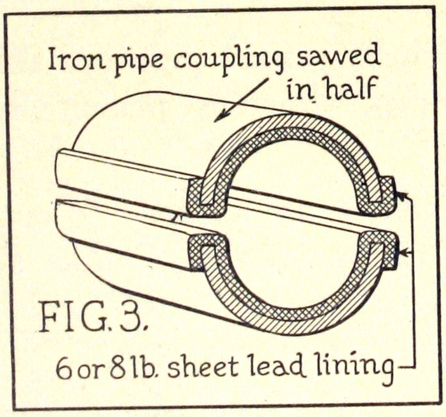
It does not matter which pattern is used so long as the reinforcements are strong enough to prevent the fitting from swelling and yielding to the screwing-up strains.

Pipe Vises and Pipe Tools

The ***pipe vises*** used in brass pipe work are those commonly used in iron pipe work. It is not necessary to purchase special vises for brass pipe. It is advisable however to have a set of friction clamps to protect the pipe from the teeth of the vise. Plumbers either purchase or make these clamps themselves. A set will last a long time.

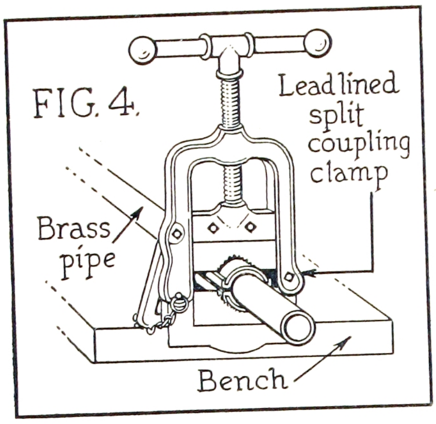
Making a Friction Clamp

A popular form is shown in Fig. 3. A common steel pipe coupling is sawed in halves. Then each half is lined with a piece of 6 or 8 lb. sheet lead, this being squeezed into the coupling threads by screwing down the clamps and lead pieces tightly over a piece of brass or iron pipe in the vise, then beating the edges of the lead over the iron half-coupling, substantially as shown. The coupling threads penetrate the sheet lead and help to hold it



Friction Clamp

firmly in place. The lead lining thus fits snugly around the pipe, furnishing a large bearing surface which holds by friction, not by teeth cutting into the brass.



Using the Friction Clamp

Fig. 4 illustrates a piece of brass pipe held firmly in a pipe vise by such a clamp. The jaws are first opened out, the brass pipe is then slipped in between them, then the the clamps are placed between the brass pipe and the vise jaws. The jaws are then screwed tightly on the clamps and the lead holds the pipe by friction.

To Prevent Slipping

To prevent the pipe from slipping in the clamps the lead linings may be sprinkled with powdered resin before the pipe is set in them. The resin makes the lead grip the pipe firmly and still does not cut into it. Thus in all respects, except the placing of friction clamps in the vise, the operation is the same as in iron pipe work.

Cutters

The ***cutters*** used for cutting brass pipe are the same as those used for iron pipe, which are principally three wheel cutters.

But owing to the fact that brass is easier to cut, the cutter wheels may be thinner if the plumber so desires. This materially reduces the "burr" which forms inside the pipe as the cutters penetrate.

Any cutter that will cut iron or steel pipe can be used on brass pipe successfully. Also any reamer, and any reaming process used on iron or steel pipe will work equally well on brass pipe.

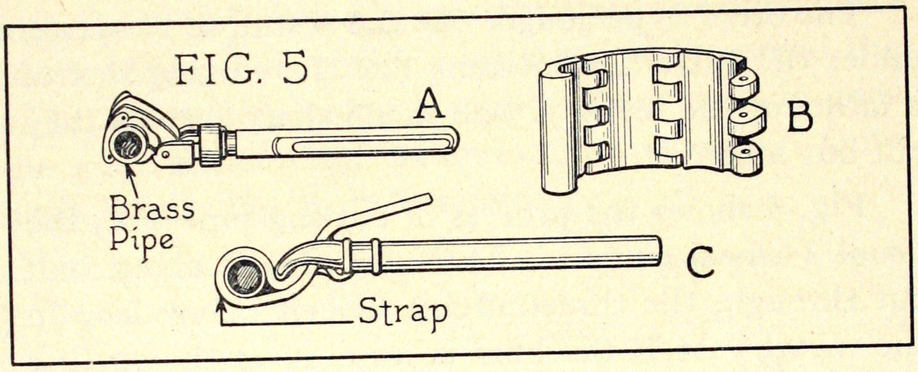
The dies used for brass pipe also are the same as those used for iron or steel pipe. The regular iron

pipe dies may be taken off an iron pipe thread and, without any change, will run a thread on a piece of brass pipe.

Wrenches

Avoiding Wrench Marks

The ***wrenches*** used for screwing up brass pipes into brass fittings may be the regular "Stillson" wrench if the teeth marks are not objectionable from an appearance standpoint. If, however, it is desired to have no wrench marks on the pipe, then friction wrenches should be used. This type of wrench is used on plain pipe, the fittings being held against the pipe-wrench with a monkey wrench.



Types of Friction Wrenches

Fig. 5 illustrates a type of friction wrench gripping a brass pipe at A, and at B is seen a detail of the hinged clamps or "girth" which grips the pipe only by friction. This is an excellent type of wrench for brass pipe work. It grips tightly, works quickly, and does not crush nor mar the pipe.

Nickel plated, or polished brass pipe should be screwed up with a strap wrench to avoid scratching the finish. In this type of wrench the pipe is held tightly with a linen strap, and by friction only.

Strap Wrenches

Fig. 5C is an illustration of a strap wrench in action. The strap is seen wrapped around the pipe and slipped through the eye of the lever handle. Force is applied to the lever in the direction of the arrow. It tightens the strap around the pipe and so the pipe is turned by friction as one would turn it with his naked hand, only with much greater

power and with the same freedom from marks on the finished surface.

Cutting Brass Pipe

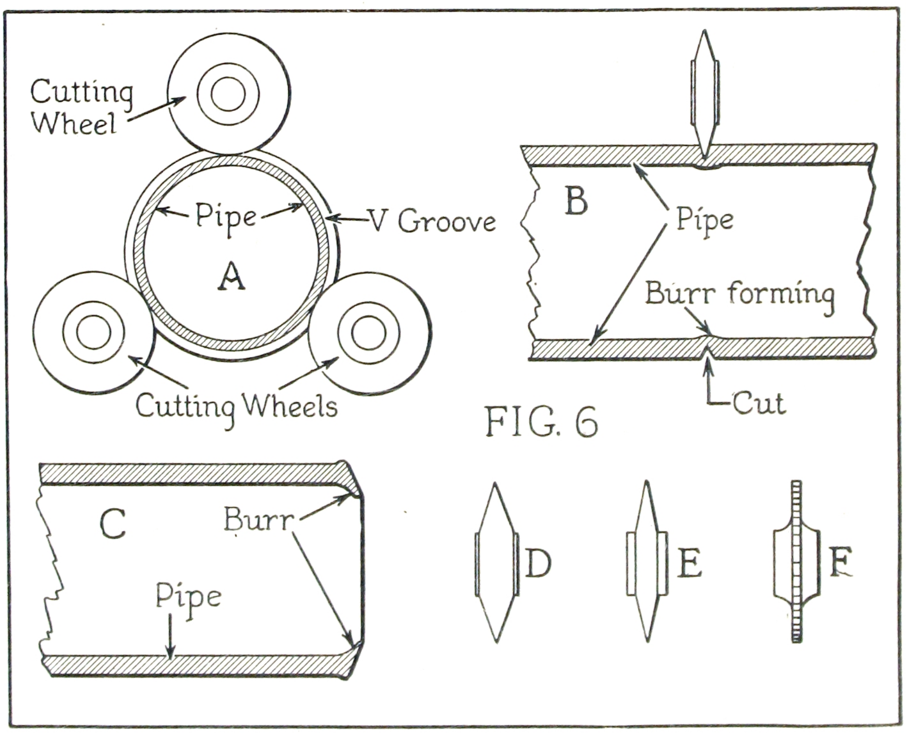
Brass pipe may be cut either with hack saws or pipe cutters.

There are two types of ***pipe cutters*** which are adapted to both iron pipe and brass pipe. One type cuts into the metal by separating it with sharp revolving wheel cutters. This type squeezes the metal partly inside the pipe, and makes a "burr" which, if not reamed out, restricts the bore and reduces the flow of water through the pipe.

The other type gouges out the metal, so to speak, under the cutters, something like the cutting tool of a lathe, or the teeth of well made sharp dies as they cut out a thread.

Wheel Cutters

Fig. 6 shows the process of cutting pipe with the usual 3 wheel cutters. At A the pipe is about half cut through, the three cutting wheels being deep in the metal. At B the burr is forming as the cutting wheels are being revolved around the pipe and



Process of Cutting the Pipe

screwed deeper into the metal with each revolution. At C is seen a section through the end of a pipe that has been cut with dull or old fashioned cutting wheels. Note how deeply the burr extends into the pipe thus reducing its diameter at that point.

Getting Rid of Burrs

The burr at C is deep, being made with a badly shaped cutter something like Fig. 6D. This cutter wheel is too thick. A superior cutting wheel is seen at E. It is much thinner, cuts through easier and quicker than D and makes a much smaller burr. Cutters of this type are preferable. At F, Fig. 6, is shown a thin blade wheel cutter with a "knurled," instead of a "knife" edge. The blade is less than $\frac{1}{16}$ inch thick and perfectly straight from the hub to the outer edge. This cutter does not simply spread the metal apart, but makes a square, clean cut and does the work easier than common cutter wheels. Only a small burr has to be removed.

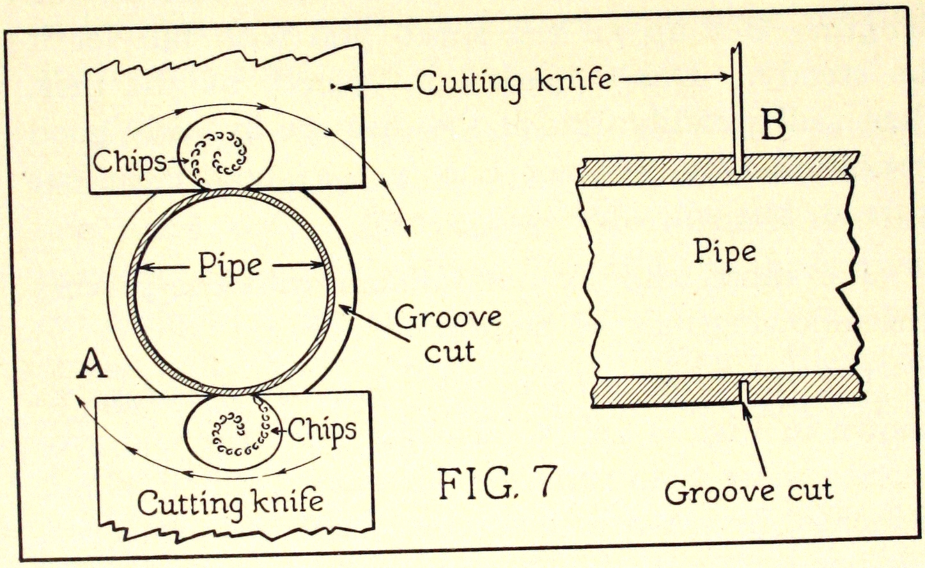


FIG. 7

Another Method of Cutting

The other cutting process is illustrated in Fig. 7. The brass pipe is held in the vise between clamps. The cutter is slipped over the pipe. The cutting knives are screwed down against the pipe. Then the cutter is revolved around the pipe in the direction of the arrows shown at A. The cutting edges of the knives gouge out the metal and form a groove the width of the cutting knives which is seen in view B.

Clean, Square Cuts

The cutters may be fed into the groove automatically by springs back of them, so that once the cutters are in place and started there is no occasion for the plumber to stop and "feed in" the knives by turning handles. He just keeps on revolving the cutter around the pipe till the piece drops off. By this method a clean, square cut without any burr is obtained. It is an excellent method of cutting pipes.

Threading Brass Pipe

There is no difficulty in the threading of modern brass pipe by plumbers. They can use exactly the same dies that they have used for iron pipe. They do not even have to change the adjustment of the dies, but go ahead and thread the pipe as if it were iron. Start the thread in the usual way, then pull easily and steadily until the thread is run up full length. Get up all the speed you wish but let it be steady. Don't "jerk" or "yank" at the dies. Just pull steadily, and if the dies are in fairly good condition, you will not only get a good, clean-cut thread, but will save energy too.

For those who are not familiar with the process the following may be helpful:

Fix the brass pipe in the vise, using clamps as shown in Figs. 3 and 4. Do not have the end projecting more than sufficient for easy working, about 6 inches, from the face of vise. The less projection the better. It makes the pipe stiffer in resisting the threading strains.

Good Threads

Examine your dies and see that they are set to correct gauge mark so that they will cut the thread standard size, not more, not less, just exactly standard. Remember that the fittings are tapped standard thread, and the thread you cut on the pipe end must match the fitting thread exactly. By cutting an exact-to-standard thread you will have a good tight metal-to-metal screw joint when the thread is

screwed up in its fitting. Otherwise the pipe thread will be too tight or too loose for the fitting.

Also blow, or scrape out any chips or dirt that may have been left in the dies from the last threading operation, especially if this was on steel. Clean, sharp dies should always be used in threading brass pipe, or any other metal. Dies with chipped teeth, or metal chips clogging them, or sand or dirt in them, should not be used. To obtain good, sharp, clean-cut full threads—that is, perfect threads—you must have good, clean, perfect dies. That applies to the threading of iron and steel pipes as well as to brass and copper.

Starting the Thread

Knowing that the dies are O. K. slip the guide end over the pipe (this refers to hand cut threads at the pipe vise—not machine cut threads). Then start the thread. The starting of a thread is the only part of the threading process where it may pay to jerk the dies a little, and then only when the dies are hard to start.

After a few revolutions, if the dies have caught, they will be felt growing quite hard to revolve with one hand only. Then apply both hands to the handles, and pull slowly at first and the thread will cut along nice and steady, giving an even resistance to the pull. But if they have not caught, they will quickly strip the thread and ease up the resistance to the pull on the handles.

These few pointers combined with a little experience will enable one to properly start a pipe thread by hand.

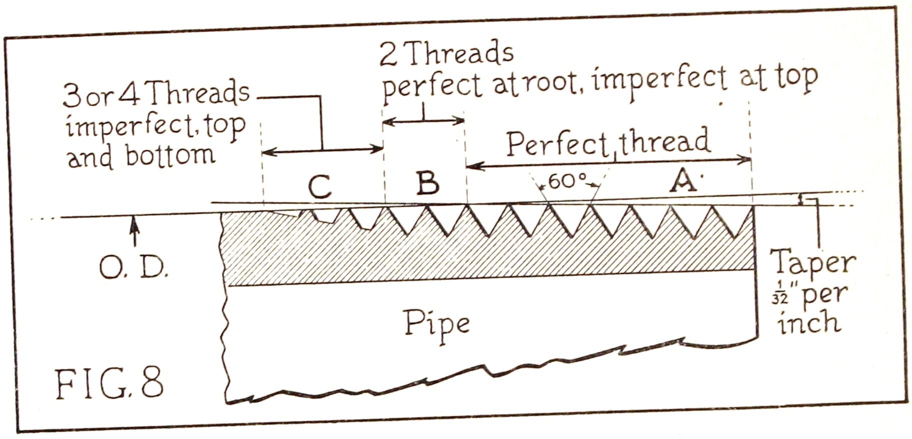
Use of Lubricants

Some plumbers use oil or soapy water on the threads while cutting them. The idea is to keep the die teeth cool, and to lubricate the dies. It helps also to stop the squeaking which is characteristic of brass pipe threading. Others do not use lubricant. They run up the dies dry and let them squeak. Either method will do.

Perhaps the most important thing the plumber

has to attend to in running up the dies is to know when to stop and reverse them. All threads on brass, as well as on iron and steel pipes, must be the right length. That is to say they must be run long enough to obtain three or more perfect threads to insure a thorough and full metal-to-metal contact when the threads are screwed "home" in their fittings.

Length of Threads



Standard Pipe Thread

To understand this fully refer to Fig. 8 which illustrates the standard thread, one that is accepted throughout the United States as standard, and used on wrought iron, steel, brass, and copper, steam, gas and water piping. It is the "Briggs' Standard" pipe thread previously mentioned. The thread has an angle of 60 degrees, and is rounded off slightly at top and bottom. The depth of each full thread is 0.8 of the pitch or distance from thread to thread.

Note that this thread is composed of three distinctly different parts. The part A has all perfect threads. They are perfect top and bottom. At B there are two threads perfect at bottom, or root, but imperfect at top. At C there are three or four threads imperfect at both top and bottom, but perfect at the sides.

The object in having the threads at C not cut down to their roots is to give strength to the pipe here. The two imperfect threads at B cannot be otherwise because this is the point where they "die out" at the outer surface of the pipe. The threads

at A however are all cut well within the body of the metal and consequently are full and perfect at top as well as at the roots.

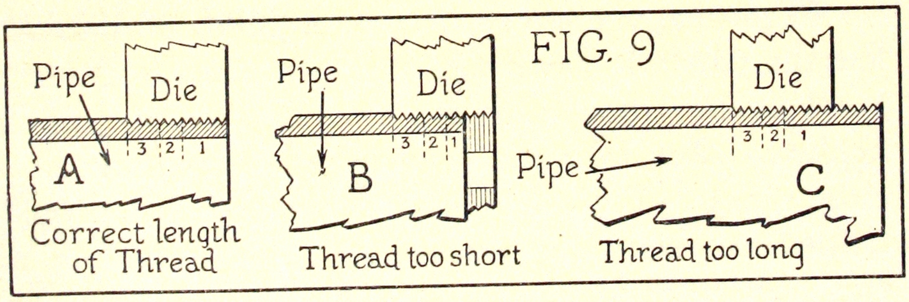
Water-tight Fit

That is the portion of the thread which plumbers have to depend upon for water-tightness of the screwed joints. The portions B and C are just "tapering off" extensions of the perfect thread and are there only to strengthen the pipe at the fitting.

The point here emphasized is that plumbers in making threads should see that they approach this general form. It may not be necessary on all classes of work to have as many perfect threads as there are shown in Fig. 8, namely, seven. Three or four usually are quite satisfactory provided the threads in the fittings where these perfect male threads fit in, are also perfect.

The threaded ends of pipe are cut conical, with a taper of ¾ inch to the foot, or 1 in 16 to the axis of the pipe, which is clearly shown in Fig. 8. This makes the thread enter the fitting easily at first, tightening as it goes in. Incidentally, also, it produces that enormous outward thrust which tends to swell or split the fitting if it is too weak.

Fig. 8 and the foregoing reference to it are sufficient to explain just how far a plumber should run up his dies. **If the dies are correctly made and properly adjusted, the threading may be stopped when the pipe end is flush with the face of the dies as at A in Fig. 9.** This is the correct length for the thread. That is standard.



Correct Length of Thread

Some plumbers may feel disposed to save in threading labor by setting the dies a little closer together. This enables them to cut shorter threads as at B Fig. 9.

Certainly these short threads will screw into standard tapped fittings all right. But note that the number of perfect threads is cut down from 4 or 5 to perhaps only 1. That lessens the chance of having the joint water-tight when screwed up as tight with the wrench as the one shown at A. But it does not have as much perfect thread contact and therefore cannot be depended on for water-tightness as much as that in sketch A. Threads like that shown at B are not considered good practice. Besides they usually require considerable "dope" to make them water-tight.

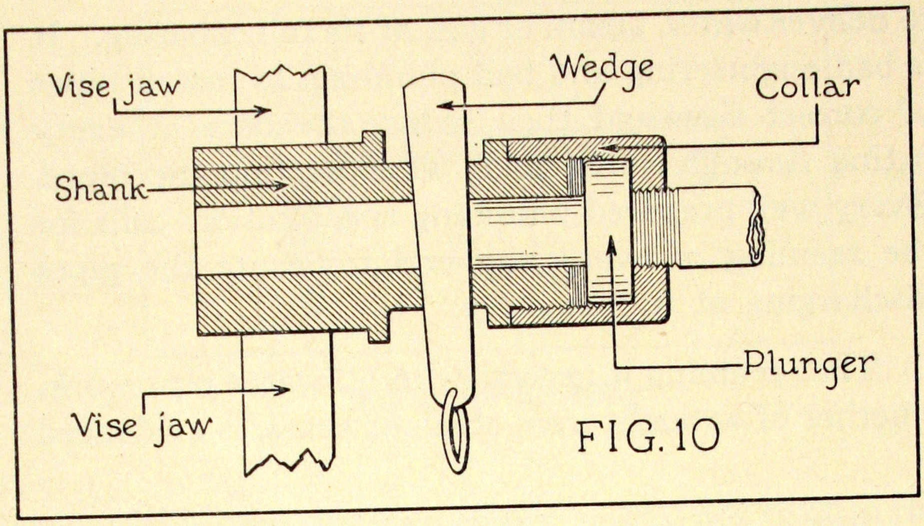
Getting Tight Contact

At C Fig. 9 is a thread that is too long. Those projecting beyond the dies are useless threads. They have no taper. The tendency is for these non-taper threads at the point to set up tight away back in the fitting before the imperfect threads at Nos. 2 and 3 are screwed up tight. In such a case the non-taper threads may be tight and the others all loose. A perfect joint demands tight contact at every thread.

Plumbers are cautioned against making threads either too short or too long, as at B and C, but should cut threads the full thickness of the die, as in sketch A. It is assumed that the die is made right, and of the correct thickness, so that the full length of standard thread will be obtained when the pipe end is flush with the face of the die.

Threading Nipples

Regarding the ***threading of nipples*** of different lengths, which is something that plumbers frequently have to do, they may be held in suitable nipple holders. For example consider the threading of a close nipple. Fig. 10 illustrates a nipple in a nipple-holder all ready for threading. The operation of this particular form of holder, which is a good one, is as follows:



How to Thread Nipples

Place shank part of holder in the vise and hold it tight. Screw the already threaded end of the nipple into the collar as shown. Drive in the wedge lightly with a hammer. Then, using the collar as a guide for the dies, proceed to thread the end of the nipple. When the thread has been run the full length, run back the dies, and the nipple is threaded.

Removing the Nipple

To remove the nipple, drive the wedge back and unscrew the nipple by hand. This can be done because the thread in the collar is a little deeper cut than Standard. Consequently the nipple thread fits loosely in it. It is the wedge forcing the face of the plunger against the nipple face that prevents the nipple from turning while being threaded, and from coming out with the dies when their motion is reversed. This is a very simple operation which any plumber can easily perform if he has a good nipple-holder.

Reaming Brass Pipe

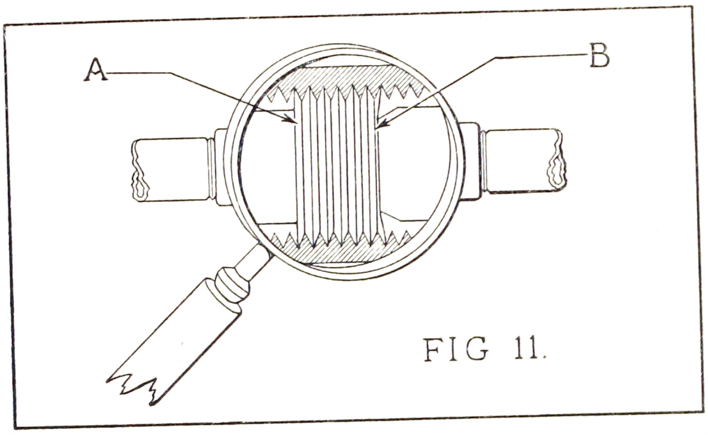
Generally speaking every cut pipe-end should be reamed after it has been threaded so that any burr, no matter how small, even if it is only a ragged sharp edge, will be removed.

The only object of reaming is to enable the pipe

to deliver water, steam or gas, at its full capacity. It is bad engineering and bad plumbing to install pipes of correct sizes and then reduce the bore at every fitting through burrs made while cutting the pipes. Every well prepared plumbing specification calls for the reaming of every pipe-end to insure the pipes discharging at full capacity.

Reaming

That reaming is necessary in all water pipe work, whether of wrought iron, steel, or brass, is evidenced



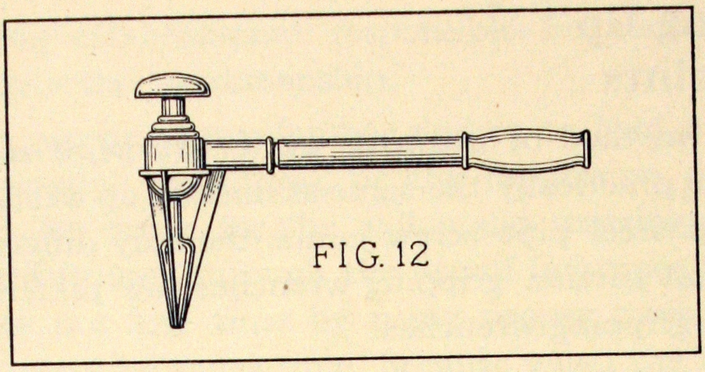
Avoiding a Burr

by sketch Fig. 11 which gives a cut-away view of an ordinary pipe-coupling magnified. The pipe end at A has a square-cut edge with no interior projecting burr to interfere with the flow. But the pipe end at B has a heavy burr, which projects well into the pipe, reducing its bore greatly and thus preventing it from delivering water at its full capacity. It is almost needless to say that this burr should have been reamed out.

A Suitable Tool

A type of tool suitable for reaming pipe-ends and one that is extensively used by plumbers is shown in Fig. 12. Its operation is simple. After the pipe-end has been threaded, and before taking the pipe out of the vise, insert the point of this conical reamer in the pipe-end, press it in hard with one hand on the knob, and with the other hand work the handle.

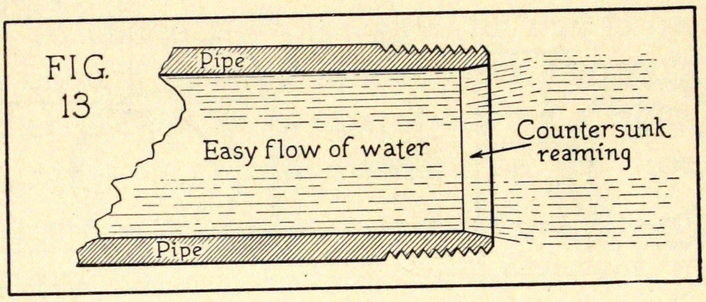
This is a ratchet reamer and so the operation of the handle is just like that of a pitcher spout pump.



A Tool for Reaming

Increased Carrying Capacity

In reaming the pipe-ends it is well not to stop the instant the burr, or rough edge, is removed and the exact diameter of the pipe is attained. Just keep on a little longer until the pipe-end is funnel mouthed



Countersunk Reaming

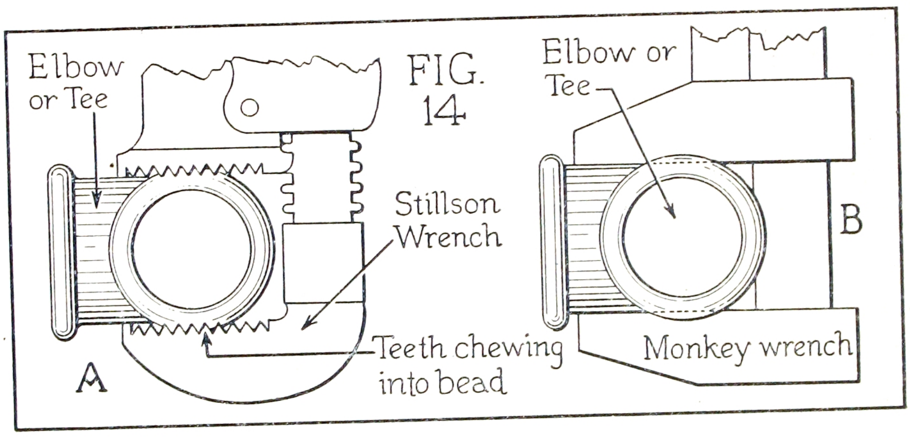
slightly as in Fig. 13, and this will increase the carrying capacity of the pipe to its maximum limit. This countersunk reaming is superior to the clean-cut square edge, as it eliminates what is known in hydraulic engineering as the "vena-contracta," or contracted vein. It is good to know that the evil influence of the burr can be so easily overcome by the simple process of reaming the pipe-end until it is countersunk substantially as in Fig. 13. This represents first class reaming.

In all brass pipe work reaming pipes this way is advised as it enables them to deliver at their maximum capacity.

Making Up the Joints

The method of ***making up brass pipe screw joints*** is practically the same as making up wrought-iron and steel pipe screw joints, the only difference being that friction gripping wrenches are preferable to teeth-gripping wrenches.

In screwing up a brass fitting on a pipe, or nipple, in the vise, it is advisable to turn the fitting with a monkey wrench, which has smooth jaws, rather than with a stillson wrench, which has teeth in its jaws. The object is to prevent cutting into the bands of the fitting and so reducing their strength.



Kind of Wrench to Use

Fig. 14 illustrates what is meant. A stillson wrench is shown in the act of turning a brass elbow or tee at A. Note how the teeth cut into the brass bead. This practice is wrong. Brass fittings should never be "chewed into" with such wrenches.

Correct Practice

The correct practice is to use a monkey wrench as shown at B in the same figure. The flat smooth jaws are screwed down tight over the body of the fitting. Then the fitting can be screwed up without marring or weakening it in any way.

When an owner, architect, or sanitary engineer, sees brass pipe fittings or brass pipe marked with wrenches, he immediately brands as incompetent the

plumbing establishment responsible for such glaringly defective workmanship.

A Satisfactory Job

If a journeyman plumber desires to hold up his own personal reputation, or the reputation of the concern he works for, he will avoid marring brass pipe and fittings through the use of improper tools. He does not lose time by using proper tools. On the contrary he saves time, because when the water is turned on, the job is found satisfactory.

In screwing a fitting on a pipe held in the vise, the pipe should project as little as possible beyond the vise, the same as mentioned for threading.

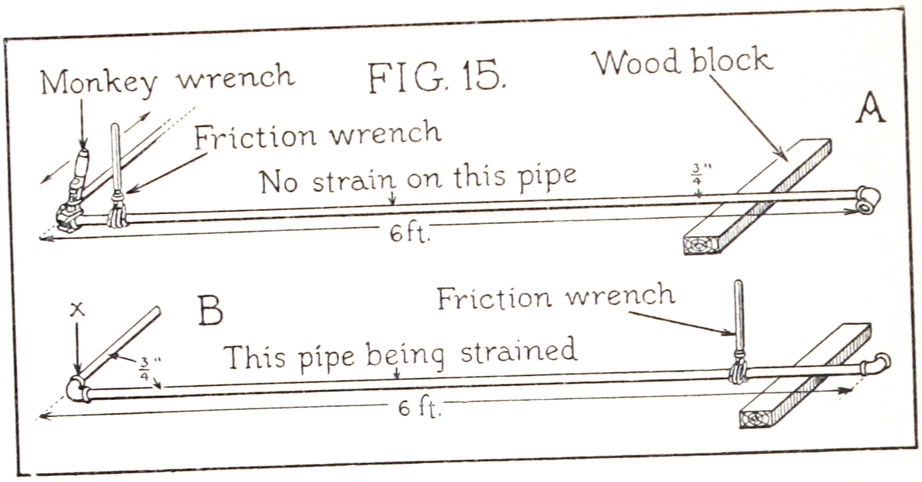
That is to allow the fitting to be screwed up quite tight without danger of splitting, bending, or twisting the pipe. Every experienced plumber is careful in this respect. It seems to come to him as "second nature" to clamp the pipe with its end projecting just far enough to allow him to work the tools, and no further. Then he is sure of having a tight joint without creating excessive strains on the pipe.

In screwing up pipes in position on the job the same principles apply. Take, for example, a 6 ft. length of ¾ inch brass pipe with an elbow on one end, the elbow having been screwed on at the vise which is best practice. It is required to screw this up into another elbow, say under the floor.

Friction Wrenches

The correct procedure is to enter the pipe-end thread into the elbow by hand, and screw it up by hand as far as it will go. Then apply the friction wrench, say 2 or 3 inches from the fitting into which you are screwing the thread, and set the thread up firm and tight with the wrench, holding against the friction wrench with a monkey wrench on the fitting. That is good practice and should produce a strong and permanently water-tight joint without putting unusual strain on the piping anywhere. This method is illustrated in Fig. 15 A.

At Fig. 15 B, a wrong method is illustrated. It is one which expert plumbers avoid as they know the troubles that result from such bad practice. Note



Screwing-up the Pipe

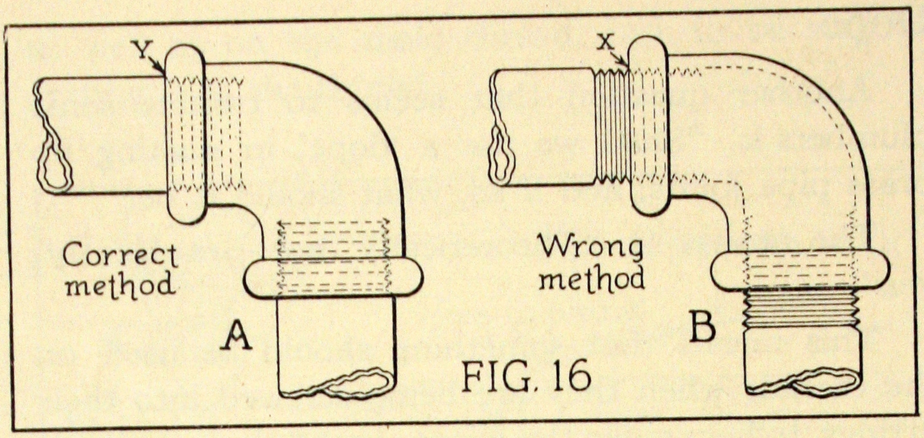
that the wrench is about 5 ft. away from the elbow into which the pipe is being screwed. All of that 5 feet of pipe is being subjected to a severe twisting strain. The other pipe is also submitted to excessive strains. It is not a twisting strain but a cross strain which tends to snap the pipe at X where it is cut away at the thread.

In addition to these unnecessary strains being put on the pipe, it is a fact that joints cannot be screwed up as tightly nor as quickly by the method shown at B as they can by that shown at A. Therefore method B is not advisable.

A General Rule

The general principle which is exhibited at A in Fig. 15 should be applied throughout a brass pipe job. That is to say, grip the pipe close to the fitting into which it has to be screwed, and hold the fitting tight against the pull of the friction wrench. It is easy. Just work the friction wrench with one hand and hold the fitting with a monkey wrench in the other hand. This applies to the smaller sizes of pipe. The larger sizes require the plumber to be on the friction wrench with both hands and his helper holding against him with a large wrench on the fitting.

Plumbers have often raised the question—"Just how far should a brass pipe thread be run into a brass fitting?"



Correct Screwing-up

Some say it should be run in full length so that no thread is seen as at A in Fig. 16. Others say it should have a few threads showing outside of the fitting as at B Fig. 16. 16-A is correct and 16-B is wrong.

Strong Joints

Water-tight joints can be made either way. But it is known that in method B the physical strength of the pipe is greatly reduced at the exposed threads because the metal has been cut away leaving the pipe much thinner at the thread roots.

All pipes on a job have to stand certain strains from expansion and contraction, structural conditions, and otherwise, which tend to break them at the fittings. It is evident that the pipe at X, Fig. 16, is much weaker than that at Y, and is therefore more easily broken when installing or in service.

If the fittings are not tapped full enough plumbers are thus compelled to cut their threads deeper than standard in order to have concealed threads. They have to cut out too much metal, which weakens the pipe unnecessarily, and is bad practice.

What is wanted is not fittings tapped too small, but accurately tapped fittings which will allow standard male threads to make up full with no threads exposed. Then the best kind of screwed joints result and a maximum pipe-strength remains.

Dope

Another question that seems to trouble some plumbers is, "Shall we use a 'dope' in making up brass pipe joints, and if so, what should it be?"

The answer is: "Theoretically, no—**practically,** yes."

This means that something should be used on the threads when they are being screwed into their fittings, to help make the joints absolutely water-and-gas-tight.

The Use of "Dope"

With an absolutely perfect thread on the pipe-end, and an absolutely perfect thread in the fitting, both threads being perfectly clean, and exactly the same in pitch and angle, etc., it is quite possible to screw them together without "dope" and obtain a fine strong water-tight joint. But that calls for a higher degree of perfection than may be expected in practical work, and so the use of a dope to take care of imperfections both in the male and female threads becomes necessary.

What that dope shall be is very much a matter of opinion. Probably the best of the cement class is litharge and glycerine mixed to a paste and applied on the male thread, the female thread being left plain, but clean. The litharge fills interstices and thread imperfections, and so makes a water-tight joint.

Some plumbers who have erected very large all-brass pipe installations, use nothing but a strand of cotton wicking wrapped around the male thread. This strand enters the fitting with the thread, becomes "chewed up" into fine pieces which fill the irregularities between the male and female threads and so make a tight joint.

A Clean Packing

By using a strand of cotton on each thread, and no cement of any kind, there is no after-taste given to the water such as often happens when a cement dope is used. It is a known fact that some plumbers prefer to "smear" a little cement inside the fitting

as well as on the male thread, just to be sure of getting it in the thread.

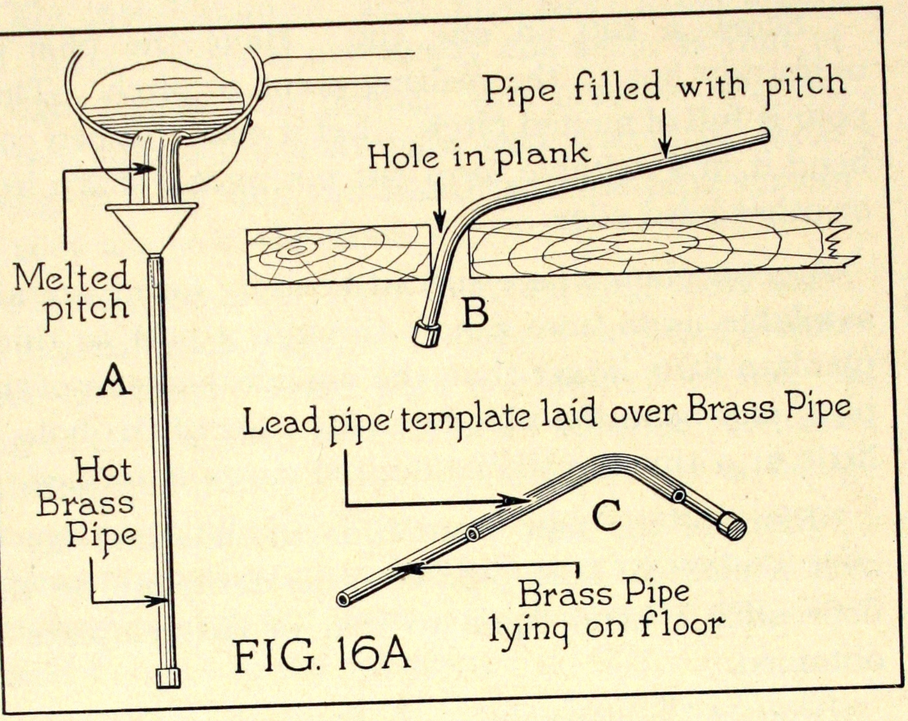


FIG. 16A

How to Bend Brass Pipe

This is pushed into the fitting by the male thread, and so gives the water a bad taste for a considerable time. It is not recommended.

The cotton wick strand is recommended in preference to the "dope" in all brass pipe installations where the water is used for drinking or domestic purposes. It costs no more, is just as easy to apply and gives cleaner results.

Red lead mixed to a paste with linseed oil may also be used.

Bending Brass Pipe

A Good Method

To properly bend brass pipe, without flattening or "kinking" it at the bend, the following method is recommended:

Heating the Pipe

Select a piece of soft pipe. If it is not soft enough anneal it by heating it to dull red at the place where the bend has to be made, then cool it.

Screw a cap on one end. Have the pipe all uniformly hot to the melting point of pitch. Then pour it full of melted pitch. Let it cool. When cold bend it in a suitable form but not over a sharp iron or other hard edge.

A good plan, where special bending forms are not available, is to bore a hole through a post or thick plank, a little larger than the outside diameter of the pipe, and bend the pipe over the edge of the hole, a little at a time, until the desired curve is formed.

Remove the pipe from time to time and lay it over a piece of lead pipe or other template on the floor until a bend equal to that of the template is obtained.

Fig. 16A illustrates the process.

The pipe is first heated, then held upright and filled with melted pitch as at A. When the pitch has set hard the pipe end is pushed through the hole in the plank and the pipe is bent over slowly as at B, the hole being large enough to let the cap go through.

Correct Shaping

The brass pipe, now bent, is laid on the floor, and the piece of lead pipe, which has previously been bent to the correct form, is laid over the brass pipe bend as at C, to determine if the brass pipe has been bent to the same shape as the lead pipe template. Having acquired the correct shape, the brass pipe is heated to melt the contained pitch which is then all poured out.

If pitch is not available melted resin may be used. If neither are available then the pipe may be filled with hot sand which must be packed tight throughout the entire length of the brass pipe and a plug driven in the end to hold the sand firmly in place. The sand is packed by beating the sides of the pipe with a soft wood block. When the bend is made the sand can be poured out of the pipe.

Installation of Brass Piping

The installation of "iron pipe size" brass piping and brass fittings is practically the same as that of wrought iron or steel piping. Any plumber who can lay out and install a wrought iron system of water piping, can lay out and install a brass pipe system for they are both the same.

Room for Expansion

He may, however, have to give a little more room for expansion of brass, and support the lines a little more carefully. Brass pipe is expected to last as long as the building because of its superior corrosion resisting qualities. It is, therefore, worthy of being correctly installed. There are three essential requirements necessary to insure a good plumbing job with any piping, but with brass particular attention should be paid to the following:

(1) All joints must be screwed up firm and be perfectly water-tight without calking or patching of any kind.

(2) The system must be supported with reasonable care so that the weight will come on the supports and not on the joints.

(3) Provision must be made for the expansion and contraction of all brass piping, particularly the hot water piping.

The actual work of threading the pipes and making up the joints has already been explained. That takes care of requirement No. 1.

Hangers

With reference to requirement No. 2 there is no special knowledge necessary. Natural mechanical intuition and common sense will be the main guide to a plumber in locating and placing his supports. For horizontal pipes ¾ inch and larger the hangers may be 10 feet apart. For ½ inch and ⅜ inch they may be 6 to 8 feet apart.

On vertical lines the supports should be one to

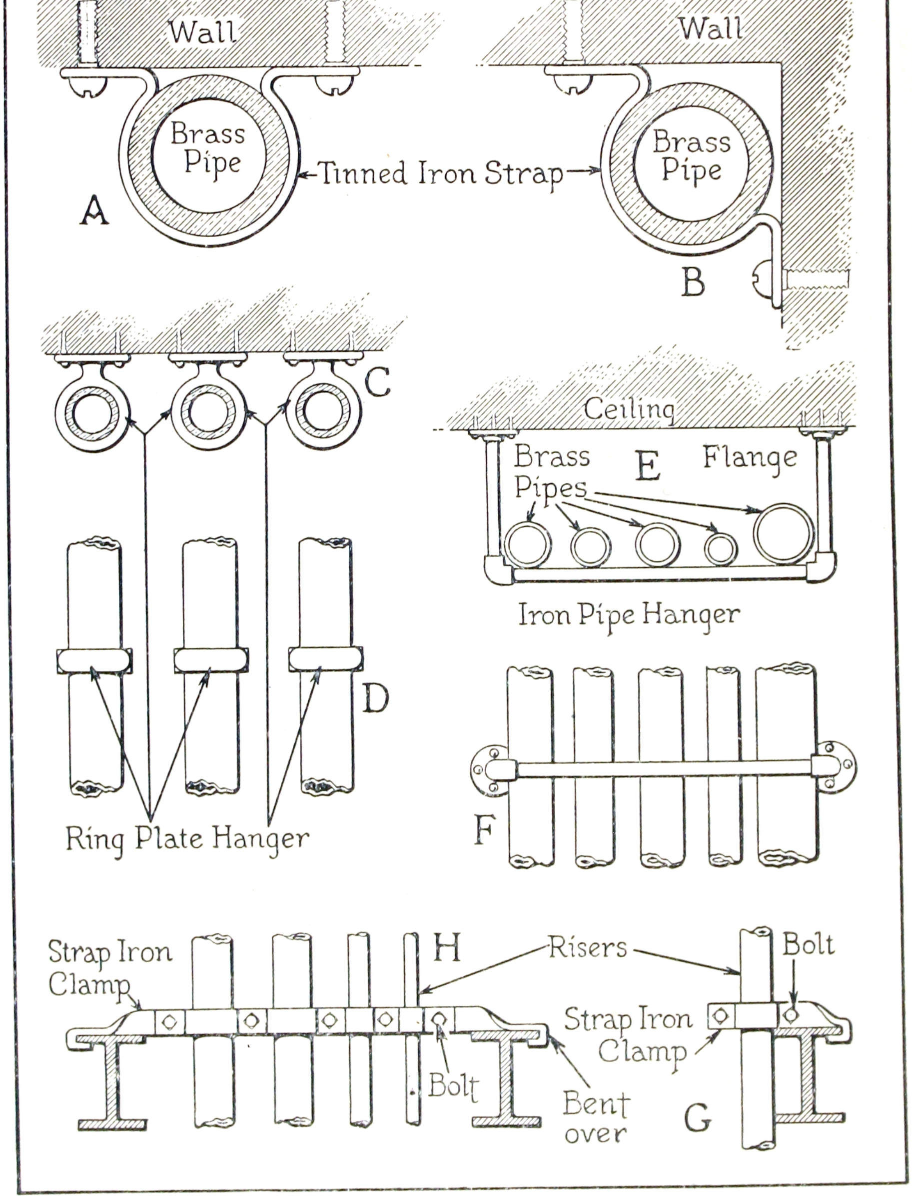
each story for pipes 1 inch and smaller, and may be one support to each two stories for larger pipes.

Any kind of hanger will be satisfactory so long as it is strong and properly located. Generally the regular galvanized ring plate hangers are used where pipes are run exposed as on kitchen, laundry, and corridor walls or ceiling.

Making Hangers

At cellar ceilings, and particularly where a large number of pipe lines run together, the plumber may make his hangers out of galvanized pipe and fittings.

FIG. 17



Types of Pipe Hangers

Fig. 17 illustrates a variety of appropriate hangers for use in different locations and under different conditions. At A is shown the ordinary inexpensive tinned iron strap hanger clasping a pipe against a flat wall or ceiling or on a floor joist, or any other place where such a hanger can be used to advantage.

Corner Hangers

At B the same hanger is strapping a pipe securely in a corner. This is not common practice with iron pipe, but is O. K. for brass pipe, particularly if the pipe is painted to match the walls. Straps, as a rule, are used principally in cellars and other places where appearance is not important and strength is paramount.

Where a neat appearance of the work is important, then the ring hangers may be used. There are two types, the solid and the split. And each of these varieties may be had either fixed length or extension. They may be seen in plumbers' supply house catalogues.

Where the pipes do not have to be hung with a pitch from beams or ceilings, the plain fixed ring type may be used. Where the pipes must be installed with a pitch, and the surface to which the hangers have to be attached is level, then use the extension hangers.

At C and D is illustrated the installation of these ring hangers. The pipe lines are from 4 to 6 inches apart and parallel to each other. That makes a neat appearance and a strong job if the hangers are spaced as previously mentioned.

Basement Hangers

In basements, etc., where the piping usually has to be pitched up toward the fixtures, and the runs are long, and particularly when a considerable number of lines can be run together, the plumber-made hanger shown at E and F, Fig. 17, is often used and gives excellent results.

At G is illustrated a simple hanger for a single pipe in a pipe shaft, or elsewhere in a large building of steel construction. A clamp made of strap iron is bolted around the pipe. The tail of the clamp is

twisted ¼ turn and bent around the flange of the steel I-beam. At H is shown a long clamp to support a number of risers. It runs across the pipe shaft and rests on the steel beams.

All of these clamps hold the pipes by friction. In addition to that they keep the risers in line.

The details shown in Fig. 17 must be taken as suggestions for there are many other forms of hangers equally good which plumbers may prefer.

Expansion

With reference to essential requirement No. 3 which relates to expansion and contraction, it should be remembered that brass pipe expands a little more than either wrought iron or steel and consequently more clearance must be given.

Avoiding Trouble

It is a simple matter to avoid trouble from expansion and contraction. All that is required is freedom for the pipes to expand and contract without placing excessive strains on the threads at the fittings.

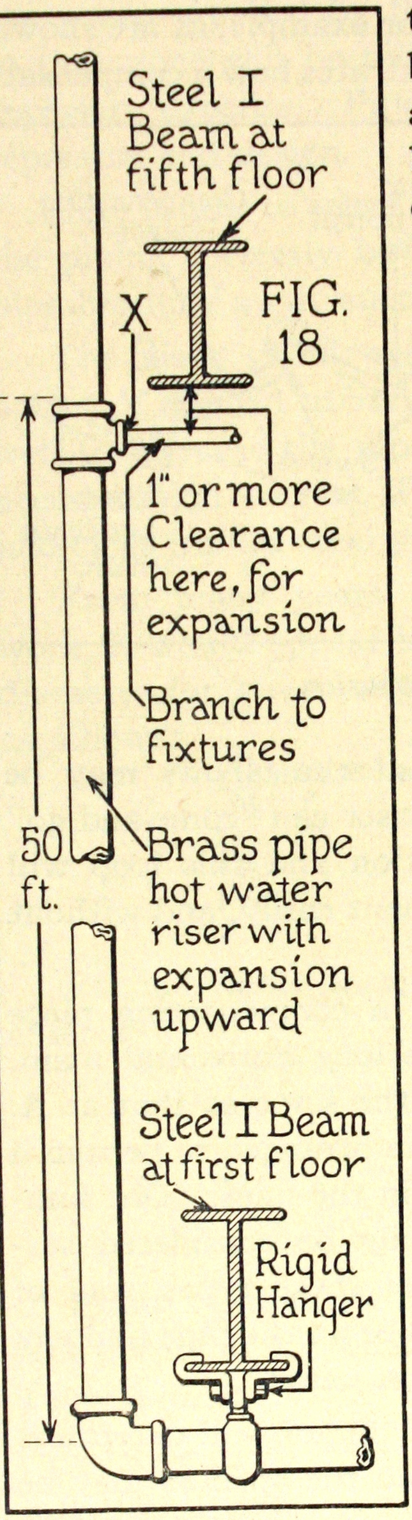
That is usually a simple matter where the piping is open. But when the pipes are imbedded in concrete, there is great danger of future leakage if proper clearance is not made all around the piping and particularly at the ends of long lines. The same thing applies to iron and steel pipes, for they expand too.

One-fourth of an inch clearance for every ten feet in length may be considered sufficient.

Pipes in Concrete

Freedom of movement for lines encased in concrete can be easily obtained by covering the piping with regular pipe covering; or in cases where the pipes are bare and short, by covering them with strips of sheet metal, or heavy roofing felt, to prevent the cement from grouting in around the pipes and fittings. With protection of this kind no trouble may be expected from expansion and contraction in short lines.

In running risers care must be taken not to bind



Clearance for Expansion

the risers by running stiff branches from them in such a manner that they bind between steel beams on different floors.

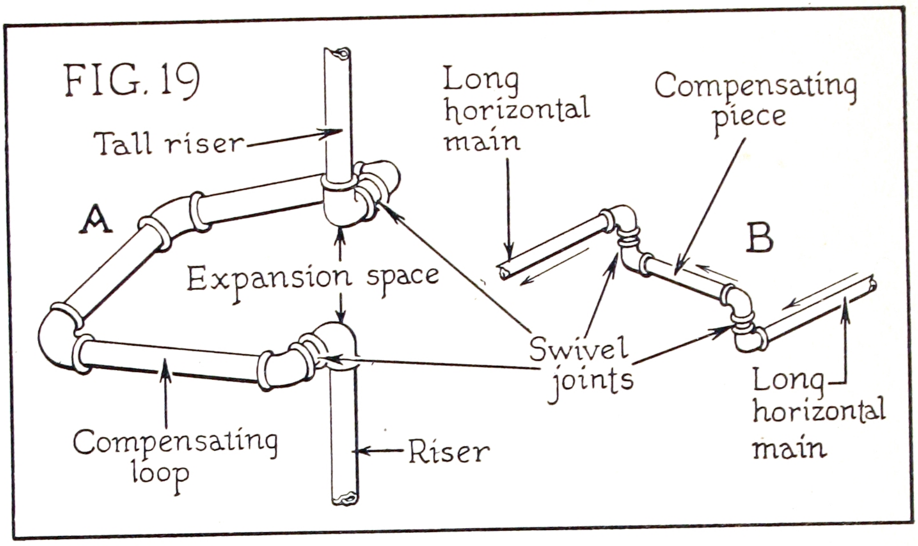
For instance, see **Fig. 18.** A brass hot water supply main runs along under a basement ceiling to feed a hot water riser. Base of riser is securely supported by a strong hanger from the I beam. That is a fixed point as far as up and down motion is concerned. The riser runs straight up to the fifth floor leaving off branches at each floor.

Upward Expansion

When the riser heats, it expands upwardly. Suppose the branch which is taken off the riser at the fifth floor is close up to the underside of the steel I beam. Then when the riser expands, the threaded end of the branch may snap off at the point X. The way to prevent such an unfortunate incident is to have the branch at least one inch lower than the I beam when the pipe is cold. This gives ample clearance for the branch to rise as the pipe expands. The "spring" of the branch pipe, if it is a few feet long, should then take care of the expansion safely.

On long lines, or high risers with short branches taken from them, the expansion may be taken up by

special swivel offsets, such, for example, as are shown in Fig. 19. The detail A illustrates how a compensat-



Loops for Expansion

ing loop with swivel joints at the elbows may be arranged in a tall riser. The riser can "come and go" with expansion and contraction and this loop will ordinarily take up the movement easily, and without leakage.

At B, Fig. 19, is shown a compensating piece forming a swivel offset on a long horizontal main. This will take up expansion the same as that at A. In both cases the fittings are arranged to permit a grade to prevent air pockets in the lines. One hundred feet apart may ordinarily be considered sufficient for expansion joints of these types, and of course there should be an anchor on the pipe midway between each pair of expansion joints.

Varying Conditions

The existing conditions on the job will determine where the expansion pieces and the anchors may be located. Plumbers will have to examine these conditions and lay out their work accordingly.

Pipe Sizes and Capacities

In the design of hot and cold water supply systems for small and large buildings correct pipe sizes should be selected. The pipes should be proportioned just right so that none will be so small that

the water supplied by them will not be ample, and so that none will be too large, which would be unnecessary expense. Pipes too large, and too small, represent bad design.

Correct Sizes

Here is how to select correct sizes and proportion the piping correctly by simple methods which any plumber may apply successfully.

The sizes given are for brass pipe plumbing only. If applied to iron or steel pipe plumbing, it is well to increase the pipes one size to allow for the accumulation of rust which usually gathers inside and clogs iron or steel pipes.

From many years' experience on a variety of work, it would appear that reasonable differences in diameter for street service and cold water lines are as follows:

½	inch Brass or		¾	inch iron	
¾	"	" "	1	"	"
1	"	" "	1¼	"	"
1¼	"	" "	1½	"	"
1½	"	" "	2	"	"
2	"	" "	2½	"	"

For hot water lines, the following appear reasonable:

½	inch Brass or		¾	inch iron	
½	inch Brass or		1	inch iron	
¾	"	" "	1¼	"	"
1	"	" "	1½	"	"
1¼	"	" "	2	"	"
1 ½	"	" "	2½	"	"
2	"	" "	3	"	"

Determining the Flow

First: Determine approximately the required flow per minute. This may be done by reference to Table I.

TABLE I

Fixtures	Rate of Flow
Each Bath	10 gallons per minute
Lavatory	5 " " "
Tank Closet	5 " " "
Valve Closet	30 " " "
Shower	5 " " "
Sink	10 " " "
Laundry Tubs	10 " " "
Garden Hose	10 " " "

The rate of flow in Table I is that through the branches to the fixtures. In baths, lavatories, sink and laundry tubs, the rate is for both hot and cold running at the same time.

In computing the rate of flow through the mains which supply numerous fixtures, the total rate will be less than that found by Table I, because all of the fixtures will not be running at the same time.

The rate of flow in mains may as a rule be closely approximated by dividing the total found by Table I, by four for residences, apartments, schools, office buildings, and other edifices of a similar water-consuming character. For clubs and hotels divide by three. For gymnasiums, hospitals, and public comfort stations and similar water-consuming structures divide by 2. For public baths, laundries, and factories allow the full amount.

The sizes of pipes commonly used as branches to fixtures vary somewhat with the pressures at the fixture levels, and are approximately as given in Table II.

TABLE II

Sizes of Brass Water Supply Short Branches to Plumbing Fixtures

Fixture	Pressures		
	High over 70 lbs.	Medium 40 to 70 lbs.	Low under 40 lbs.
	Inch	Inch	Inch
To Baths	1/2	3/4	1
Lavatories	3/8	1/2	1/2
Tank Closets	3/8	1/2	1/2
Valve Closets	3/4	1	1 1/4
Pantry Sinks	3/8	1/2	1/2
Kitchen Sinks	1/2	3/4	3/4
Slop Sinks	1/2	3/4	3/4
Showers	3/8	1/2	3/4
Urinals	1/2	3/4	3/4
Fountains	3/8	3/8	1/2

TABLE III

SIZES OF BRASS PIPE MAINS IN BUILDINGS

Pressure Drop Lbs.	LENGTH—100 FEET. APPROXIMATE DELIVERY IN U. S. GALS. PER MINUTE								
	½ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch	2½ inch	3 inch	4 inch
17	3.2	9.1	18.7	33.5	51.6	105.8	200.0	290.0	589.0
30	5.0	13.8	28.3	52.0	78.0	159.7	308.0	436.0	885.0
40	5.8	15.9	32.7	60.0	90.0	184.4	350.0	504.0	1023.0
50	6.5	17.5	36.6	70.0	100.7	206.2	390.0	564.0	1143.0
60	7.0	19.5	40.0	76.0	110.3	225.9	430.0	617.0	1252.0
75	7.5	21.8	44.8	85.0	123.4	252.6	480.0	690.0	1400.0
100	9.0	25.2	51.7	99.0	142.4	291.6	558.0	797.0	1617.0

To save time in proportioning the water mains and their branches, Table IV may be used.

After finding the rate of flow by Table I and dividing for different classes of buildings, the sizes of the water mains in a building may be determined from Table III. This table states the approximate quantities of water that different sizes of brass pipe will deliver under various pressure drops.

TABLE IV

Approximate Numbers and Sizes of Branches that Water Mains in Buildings Will Supply—Running Full

¾ inch will supply two ½ inch branches.
1 inch will supply two ¾ inch branches.
1¼ inch will supply two 1 inch or one 1 inch and two ¾ inch.
1½ inch will supply two 1¼ inch or one 1¼ inch and two 1 inch.
2 inch will supply two 1½ inch or one 1½ inch and two 1¼ inch.
2½ inch will supply two 1½ inch and one 1¼ inch; or one 2 inch and one 1¼ inch.
3 inch will supply two 2½ inch and one 2 inch; or two 2 inch and one 1½ inch.
3½ inch will supply two 2½ inch or one 3 inch and one 2 inch; or three 2 inch.
4 inch will supply one 3½ inch and one 2½ inch; or two 3 inch; or four 2 inch.

While these tables may be considered quite reliable for the average plumbing installation there may arise cases where a special study should be made of the conditions and requirements, and the piping proportioned accordingly.

Brass or Copper Water Service Pipes

The installation of copper and brass as service piping is steadily increasing. Water companies and municipalities recognize the advantage and economy of installing materials that will avoid the necessity of tearing up pavements to replace corroded products. Soft copper pipe will prove highly satisfactory when used as a gooseneck.

Copper Boilers

Copper range boilers and copper tanks for water storage purposes are now being used extensively. The efficient and satisfactory service given by copper boilers and tanks is well known to most plumbing contractors as a promoter of high reputation for their installations.

The Copper & Brass Research Association will be glad to assist plumbing contractors in solving problems which may confront them.

SEAMLESS BRASS AND COPPER PIPE

IRON PIPE SIZE

REGULAR					EXTRA HEAVY				
STANDARD SIZE	DIAMETER, INCHES		POUNDS PER FOOT*		STANDARD SIZE	DIAMETER, INCHES		POUNDS PER FOOT*	
	Outside	Inside	BRASS	Copper		Outside	Inside	Brass	Copper
1/8	.405	.281	.246	.259	1/8	.405	.205	.353	.371
1/4	.540	.375	.437	.459	1/4	.540	.294	.593	.624
3/8	.675	.494	.612	.644	3/8	.675	.421	.805	.847
1/2	.840	.625	.911	.958	1/2	.840	.542	1.191	1.253
3/4	1.050	.822	1.235	1.298	3/4	1.050	.736	1.622	1.706
1	1.315	1.062	1.740	1.829	1	1.315	.951	2.386	2.509
1 1/4	1.660	1.368	2.557	2.689	1 1/4	1.660	1.272	3.291	3.460
1 1/2	1.900	1.600	3.037	3.193	1 1/2	1.900	1.494	3.986	4.191
2	2.375	2.062	4.017	4.224	2	2.375	1.933	5.508	5.791
2 1/2	2.875	2.500	5.830	6.130	2 1/2	2.875	2.315	8.407	8.839
3	3.500	3.062	8.314	8.741	3	3.500	2.892	11.24	11.82
3 1/2	4.000	3.500	10.85	11.41	3 1/2	4.000	3.358	13.66	14.37
4	4.500	4.000	12.29	12.93	4	4.500	3.818	16.41	17.25
4 1/2	5.000	4.500	13.74	14.44	4 1/2	5.000	4.250	20.07	21.10
5	5.563	5.062	15.40	16.19	5	5.563	4.813	22.51	23.67
6	6.625	6.125	18.44	19.39	6	6.625	5.750	31.32	32.93
7	7.625	7.062	23.92	25.15	7	7.625	6.625	41.22	43.34
8	8.625	8.000	30.05	31.60	8	8.625	7.625	47.00	49.42
9	9.625	8.937	36.94	38.84					
10	10.750	10.019	43.91	46.17					

* These weights vary somewhat in practice.

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2461-3 East 8th St., Los Angeles, Cal. (Chase Companies of Cal., Inc.)

T. E. CONKLIN BRASS & COPPER COMPANY, INC.
54-60 Lafayette St., New York

DALLAS BRASS & COPPER COMPANY
820 Orleans Street, Chicago, Ill.

Sales Offices
Detroit, Mich.
Cleveland, Ohio

U. T. HUNGERFORD BRASS & COPPER COMPANY,
80 Lafayette Street, New York

Branch Offices and Warehouses
411-D St., Boston, Mass.
510 Arch Street, Philadelphia, Pa.
17 North Seventh St., Philadelphia, Pa.
South & Lombard Sts., Baltimore, Md.
Battery & Market Sts., San Francisco, Cal.
3035 St. Clair Ave., Cleveland, Ohio

C. G. HUSSEY & COMPANY, 2850 Second Avenue, Pittsburgh, Pa.

Branch Offices and Warehouses
504 West 24th Street, New York City
212-4 No. Jefferson St., Chicago, Ill.

Branch Office
First National Bank Bldg., Cincinnati, Ohio

MERCHANT & EVANS CO., Washington Ave. at 21st St., Phila., Pa.

Branch Offices and Warehouses
347 Sheldon St., Chicago, Ill.
242 Water Street, New York City
3125 Perkins Ave., Cleveland, Ohio.
403 Real Estate Exchange Bldg., Detroit, Mich.
24th & Jefferson Sts., Kansas City, Mo.

MICHIGAN COPPER & BRASS COMPANY, Detroit, Michigan

THE NATIONAL BRASS & COPPER COMPANY, Lisbon, Ohio

Branch Office
Suite 400-E, 30 Church Street, New York City

NEW ENGLAND BRASS COMPANY, Park Street, Taunton, Mass.

THE NEW JERSEY WIRE CLOTH COMPANY, Trenton, N. J.

Offices and Stores
210 Fulton Street, New York City
93-95 Pearl Street, Boston, Mass.
223-227 Arch Street, Philadelphia, Pa.
8 East Long Street, Columbus, Ohio

Agencies
John A. Roebling's Sons Company
165 West Lake Street, Chicago, Ill.
Station A, Atlanta, Ga.

John A. Roebling's Sons Company of Cal.
624-646 Folsom Street, San Francisco, Cal.
216 S. Alameda Street, Los Angeles, Cal.
487 Lovejoy Street, Portland, Oregon
900 First Ave. South, Seattle, Wash.

THE J. M. & L. A. OSBORN CO., 1541-51 E. 38th St., Cleveland, Ohio

THE PAPER AND TEXTILE MACHINERY CO., Sandusky, Ohio

RICHARDS & COMPANY, INC. 377 Commercial St., Boston, Mass

Branch Office
81 Fulton Street, New York City

ROME BRASS & COPPER CO., Dominick & Bouck Sts., Rome, N.Y.

Branch Offices
S. J. Marble, 233 Broadway, New York City
Finucane & Macfie, 110 East 42nd St., New York City
M. K. Williams, Mgr., 3649 South Racine Ave., Chicago, Ill.
John H. Heimbuecher Metals Co., 514 N. Third St., St. Louis, Mo.
Irvine Brass & Copper Co., 117 North Second St., Minneapolis, Minn.
Osgood & Howell, Wells-Fargo Bldg., San Francisco, Cal.

SCOVILL MANUFACTURING COMPANY, Waterbury, Conn.

Branch Offices
224 West Lake Street, Chicago, Ill.
280 Broadway, New York City
10 High Street, Boston, Mass.
1413 Pennsylvania Bldg., Philadelphia, Pa.
1213 West 3rd Street, Cleveland, Ohio
Pacific Coast Agent
Engle-Reid Co., Terminal Sales Bldg., Los Angeles, Calif.
Engle-Reid Co., 149 California St., San Francisco, Calif.

TAUNTON-NEW BEDFORD COPPER COMPANY
267 West Water St., Taunton, Mass.

Branch Offices
Rolling Mills at Taunton, Mass., and New Bedford, Mass.
35 Howard Street, New York City
61 Batterymarch Street, Boston, Mass.